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discusses the eye and optic tract of insects, his observations corroborating the opinion of the majority of previous investigators, that the retinulæ are the true nerve-end cells, while Mr. F. S. Heathcote describes a peculiar sense organ in the Myriopoda, *Scutigera coleoptrata.*——A report on the anatomy of the cotton worm moth *(Aletia xylina)* by C. S. Minot and E. Burgess, extracted from the Fourth Report of the U. S. Entomological Commission, is illustrated by five plates. They describe a membrane on the metathorax of the moth, which they regard as probably homologous with the tympanal membrane or "ear" of the locust (Acrydium).——In Biologisches Centralblatt, Feb. 1, Dr. Dewitz describes the hooked hairs of Chrysopa larvæ, and a male sexual character in Catocala, which consists of a tuft of hairs which lies in a furrow on the middle femora, and which rises like a fan out of the furrow; this has been previously noticed in this country.——In an article on the development of *Sphærularia bombi*, in Zool. Anzeiger for May 11, Professor Leuckart maintains that this parasite of humble bees is nothing else than the female sexual apparatus of a nematoid worm, a kind of transplanted organ which meets with the proper conditions for existence in the body of a foreign host.

ZOOLOGY.

INDESTRUCTIBLE INFUSORIAL LIFE.—J. Hogg describes some further experiments he has made on this subject, supplementing those previously recorded on rotifers. Some Ciliata and Tardigrada have been included, and these have, although not to the same degree, exhibited a remarkable tenacity of life. The intervals of sleep and vigorous life have also been brought into strict accord with the durations of dry and wet periods of the year, so that the subjects of the experiments have been kept in a perfectly dry condition during the whole of the long drought which characterized the past summer.

Moreover, some older dried specimens were subjected to an artificial process of desiccation. They were kept for a time in a hot-air chamber, the heat in which was raised to 200° F., and subsequently the miniature aquarium in which they were inclosed was plunged into a freezing mixture. Neither process killed them nor greatly diminished their vital powers, their revivification in both cases being somewhat delayed. Certain poisons known to exert a baneful influence over higher animals were added to the water supplied to the rotifers, but in no way did they produce discomfort; on the contrary, portions were taken into the stomach and partly digested. On the other hand, a drop of sewage water caused marked discomfort; they immediately retracted their rotating organs and sank to the bottom of the cell. These were, so far as could be ascertained, poisoned, and this was probable owing to the free sulphide of hydrogen evolved by the putrescent sewage. From

his observations the author is led to infer that rotifers will live and multiply on a very scanty supply of organic matter, provided only that the water is fairly well oxygenated. Attention is also called to the greatly diminished or no longer developed eye, due, no doubt, to the withdrawal of the stimulus of light, the rotifers being nearly always kept in the dark.—*Journal of the Microscopical Society, February, 1885.*

ON THE MORPHOLOGY OF THE CARPUS AND TARSUS OF VERTEBRATES.—As a result of embryological and literary studies I reach the following morphological table for the carpus and tarsus:

MAMMALIA.	URODELA (Menopoma, Cryptobranchus, Salamandrella, Ranodon, Axolotl).		MAMMALIA.
Carpus.	*Carpus.*	*Tarsus.*	*Tarsus.*
Scaphoideum	Radiale	Tibiale	Sesamoid articulating with naviculare and astragalus.[1]
Lunatum (intermed. Gegenbaur)	Centrale I[2]	Centrale I[3]	Distal part of astragalus.
Pyramidale (ulnare Gegenbaur)	Intermedium	Intermedium	Proximal part of astragalus (os trigonum Bardeleben).[4]
Pisciforme[5]	Ulnare	Fibulare	Calcaneus.
Centrale (Rosenberg)[6]	Centrale II	Centrale II	Naviculare.
Carpale of the rudimentary radial digit[7]	Carpale I	Tarsale I	Tarsale of the rudimentary tibial digit.[8]
Trapezium (carp. I Gegenb.)	Carpale II	Tarsale II	Cuneïforme I (tarsale I Gegenbaur).
Trapezoideum (carp. I Gegenb.)	Carpale III	Tarsale III	Cuneïforme II (tarsale II Gegenb.)
Magnum (carp. III Gegenb.)	Carpale IV	Tarsale IV	Cuneïforme III (tarsale III Gegenb.).
Unciforme (carp. IV and V Gegenb.)	Carpale V[9]	Tarsale V	Cuboideum (tarsale IV and V Gegenb.).
Metacarpale of rudimentary radial digit[10]	Metacarpale I	Metatarsale I	Metatarsale of the rudimentary tibial digit.[11]
Metacarpale I autorum	Metacarpale II	Metatarsale II.	Metatarsale I autorum.
Metacarpale II autorum	Metacarpale III	Metatarsale III	Metatarsale II "
Metacarpale III autorum	Metacarpale IV	Metatarsale IV	Metatarsale III "
Metacarpale IV autorum	Metacarpale V[12]	Metatarsale V	Metatarsale IV "
Metacarpale V autorum	Metacarpale VI[13]	Metatarsale VI[14]	Metatarsale V "

[1] Baur, G., On the morphology of the tarsus in the mammals. AMER. NATURALIST, Jan., 1885, pp. 87–88.

Baur, G., Zur Morphologie des Tarsus der Säugethiere. Morphol. Jahrb., Bd. 10, Heft 3, 1884, pp. 458–461.

Albrecht, G., Sur les homodynamics qui existent entre la main et le pied des mammifères. Presse médicale belge, No. 42, du 19 octobre, 1884, pp. 10.

Bardeleben, R., Zur Entwicklung der Fusswurzel. Sitsungberichte Jenaische

Now the question is, where are to be found the relations to the reptiles, from which mammals have probably descended? I cannot look for the six-toed forms with paddles, Ichthyosaurus, Baptanodon (Sauranodon), Plesiosaurus, etc., for I consider those modified in the same way as the cetaceans. In the living lacertilians and chelonians we find the same condition in the carpus,

Gesellschaft für Medicin und Naturwissenschaften. Jahrg, 1885. 3. Sitzung vom 6. Februar, pp. 5.

Cope, E. D, Fifth contribution to the knowledge of the fauna of the Permian formation of Texas and the Indian Territory. Read before the American Philosophical Society, August 15, 1884. Palæont. Bull., No. 39, pp. 38–41, p. 46.

Marsh, O. C., Dinocerata, a monograph of an extinct order of gigantic mammals. U. S. Geol. Survey, Vol. x, 1884, p. 146.

[2] (*Ranodon sibiricus, Salamandrella keyserlingii, Salamandrella* (*Isodactylium*) *wosnessenskyi.*) Wiedersheim. R., Die ältesten Formen des Carpus und Tarsus der heutigen Amphibien. Morphol. Jahrb., Bd. II, 1876, Taf. XXIX.

[3] (Cryptobranchus, Menopoma, Ranodon, Salamandrella, Axolotl.) Hyrtl, J., *Cryptobranchus japonicus, Schediasma anatomicum*, Vindobonae, 1865, Tab. VI, VII.

Van der Hoeven, T., Note sur le carpe et le tarse du *Cryptobranchus japonicus*, Archives Néerlandaises, T. I, 1866, pp. 22, Fig. 2 (extr.).

Wiedersheim, R., l. c. and Nachtraegliche Bemerkungen zu seinem Aufsatze. Die ältesten Formen des Carpus und Tarsus der heutigen Amphibien. Morphol. Jahrb. Bd. III, 1877, pp. 154, Figs. 2, 3, 5.

[4] Bardeleben, R., Das os intermedium tarsi der Säugethiere. Zool. Anzeiger, VI Jahrg., No. 139, 21 Mai, 1883, p. 280.

Albrecht, P., Das os intermedium tarsi der Säugethiere. Zool. Anzeiger, VI Jahrg. No. 145, 6 Aug., 1883, pp. 419–420.

Bardeleben, R., Ueber das Intermedium tarsi. Jena. Sitzungsber., 1883, 8. Juni; and loc. cit. (I have not been so happy till now to find this bone in embryos of man, Insectivora, Rodentia, Carnivora.)

[5] Leboucq, H., Recherches sur la morph. du carpe chez les mammifères. Arch. de Biologie, Tome V, 1884.

Albrecht, P., Sur les homodynamies, etc.

[6] Rosenberg, E., Ueber die Entwicklung der Wirbelsäule und das Centrale carpi des Menschen. Morph. Jahrb.. Bd. I, 1876.

Leboucq, H., Recherches sur la morphologie du carpe chez les mammifères. Arch. de Biologie, Tome V, 1884.

Baur, G., Ueber das Centrale carpi der Säugethiere. Morphol. Jahrb., Bd, 10, Heft 3, 1884.

Baur, G., On the centrale carpi of the mammals. AM. NAT., Feb., 1885.

[7] I found in a *Phalangista cookii* of 30^{mm}, received through the kindness of Professor Marsh, a rudimentary radial digit consisting of two pieces, a carpale and a metacarpale. The same condition I found in a skeleton of an adult *Chiromys madagasc.* The "sesamoid of the abductor pollicis" represents this element.

[8] I found in a *Didelphys virg.* of 15′ ^{mm}, for which I am indebted to Professor Osborn, a rudimentary tibial digit consisting of two pieces, a tarsale and a metatarsale. Conf. Bardeleben, K., Zur Entwicklung der Fusswurzel l. c. Rudiments of this digit are present in the Monotr., Rodentia, Carniv., Edent., Insectiv.

[9] This element probably existed in the Permian Urodela with five toes in the hand, and will probably be found in very young Urodela.

[10] Conf. 7.

[11] Conf. 8.

[12] Present in the Permian Urodela.

[13] Not yet found.

[14] I regard the piece in Cryptobranchus and Ranodon, hitherto considered a sixth tarsal bone, as the sixth metatarsal bone.

considering the "sesamoid" on the ulnar side, the pisiforme, *i. e.*, the ulnare; but it has not been possible hitherto to homologize directly the tarsus of the lacertilians and chelonians with that of the mammals. The Theromorpha of Professor Cope give the missing link. I believe with Professor Cope that "the subcylindric proximal part of the astragalus" is the intermedium (Professor Cope calls it erroneously centrale, but corrects this p. 46). In the distal part of the astragalus I see the first, and in the navicular bone the second central bone of Cryptobranchus, etc.

My further studies will be devoted to the morphogeny of the carpus and tarsus of the Sauropsidæ, and I shall be very much obliged to any one who may kindly aid me with material for examination.—*Dr. G. Baur, Yale Col. Mus., New Haven, Conn., April 12th, 1885*

A BLACK-FOOTED FERRET FROM TEXAS.—I recently received from Mr. G. H. Ragsdale a specimen of the black-footed ferret, *Putorius nigripes*, captured near Gainesville, Cooke county, Texas. This is the second specimen of the species from Texas thus far recorded. The first was noted by Dr. Coues in this journal, in 1882 (Vol. XVI. p. 1009), and came from Abilene, Taylor county, near the centre of the State.—*F. W. True, Curator of Mammals, Smith. Institution.*

ZOOLOGICAL NEWS.—*Vermes*—Robert Scharff (Quart. Jour. Micros. Soc.) gives the result of his investigations upon the skin and nervous system of *Priapulus caudatus* and *Halicryptus spinulosus*. The skin consists of a cuticula and hypodermis, with an extremely thin layer of connective tissue or cutis. The nervous system lies entirely in the ectoderm.

Polyzoa.—S. F. Harmer (Quart. Jour. Micros. Soc.) contributes a paper upon the structure and development of Loxosoma. The investigations were carried on upon five species found at Naples. He concludes that "in order to understand correctly the phylogeny of the Polyzoa we must derive the group from a trochosphere-like organism, and that the Entoprocta have remained permanently at a grade hardly higher than that of this hypothetical ancestor. Loxosoma shows itself the most primitive genus by the fact that it forms no colonies, by the greater development of the brain in the larva, and by the invariable presence of a foot-gland in the buds, if not in the adult." The similarity between Loxosoma and a molluscan larva (Dentalium) is pointed out, and the author concludes that "of all organisms with whose ontogeny we are acquainted, the Mollusca come nearest to the Polyzoa," and that the Rotifera must be near the Polyzoa in many points; while the Brachiopoda are much less close.

Tunicata.—M. L. Roule has described three Phallusiadæ from the coasts of Provence in addition to the two recently described by him. One of these is intermediate between Molgula and

Eugyra; while the others belong to the genera Microcosmus and Cynthia.

Echinoderms.—The stalked crinoids collected by the *Challenger* and reported upon by Dr. P. H. Carpenter, raise the total of existing generic forms to six, with no less than thirty-two species. The bathymetrical range of the tribe is shown to extend from 100 fathoms to 2500. No less than 150 species of unstalked crinoids were collected by the same expedition. In the discussion of the morphological relations between the neocrinoids and the palæocrinoids, Dr. Carpenter is, upon certain points, at issue with Mr. Wachsmuth, the highest authority on the latter group. Of the species of Pentacrinus from West Indian seas, *P. asterias*, the *Isis asterias* of Linnæus, is the rarest, while *P. decorus* is far more plentiful than *P. mulleri*. Neither of these, nor *P. blakei*, have been met with elsewhere. Two species from the Western Pacific, one from the North Atlantic, on the European side, another from the tropical Atlantic, and a single mutilated type from the Japan sea, complete the known Pentacrini. There is, in fact, but little difference between this genus and Comatula, the chief distinction being that the basals of the pentacrinoid larva are retained in the adult Pentacrinus, whilst they disappear externally in Comatula. Living Comatulæ only perform their beautiful swimming movements in order to find a suitable base to which they can attach themselves by their dorsal cirri; while the stalked Pentacrini are not seldom detached by the fracture of their skins just below a nodal joint, and they then cling to any suitable attachment by means of the cirri of that joint, which bend downwards like the dorsal cirri of Comatula. The five-chambered organ at the base of the calyx is much smaller in Pentacrinus than in Comatula, but each node of the crinoidal axis presents a dilatation similar to the five in Comatula. In the Eastern Archipelago Pentacrinus is replaced by the allied Metacrinus, eleven species of which were dredged by the *Challenger*.

Crustacea.—W. B. Spencer (Quart. Jour. Micros. Soc.) describes the urinary organs of the Amphipoda, which consist of cæca opening into the posterior part of the intestine. They are present in Gammarus, Orchestia, Talitrus, and Caprella. Mr. Spencer concludes that these organs of strangely limited distribution amongst crustacea are excretionary and probably urinary, but present knowledge does not warrant us in regarding them as strictly homologous with the Malpighian tubes of Tracheata.

M. Y. Delage has discovered a nervous system in Peltogaster, which had before been believed to be without one. Eighteen months previously the same naturalist found a nervous system in Sacculina.

Mammals.—According to F. W. True, in a communication to *Science*, the milk of *Tursiops tursio* is of the color and consistency

of cream, without perceptible odor, and with the flavor of cocoa-nut milk. The fishermen state that this species, which is the one most common on the Atlantic coast, cannot remain under water more than four or five minutes. The color of the back, in some examples taken at Cape May Point, was a light plumbeous tint, but it appears that the depth of the color varies in different individuals, and deepens rapidly after life is extinct, especially if the specimens lie in the sun.

M. Paul Albrecht, in the *Pressé Medicale Belge*, 1884 (October), states that there are fourteen digits in the vertebrate foot. Seven of these are radial and tibial, one is axial, and six are ulnar and fibular.

M. Retterer, in a thesis presented to the Faculty of Sciences of Paris, describes the early stages of the limbs and feet in various mammalia. He shows that the primitive cartilages display the same numbers and character as the bones of the adults in a great many cases.

EMBRYOLOGY.[1]

ON THE EMBRYOLOGY OF LIMULUS POLYPHEMUS.[2] III. — The stage under examination is that represented on Figs. 12 and 13, 14 and 15 (Plates III and IV) of my essay on the development of Limulus (Memoirs Boston Society Natural History, 1872). At this stage the oval blastodermic disc, with the six pairs of the cephalic appendages, is distinctly formed; the mouth is seen in a position in front of the first pair of appendages, and from it the primitive streak passes back to the posterior margin of the blastodermic disc or "ventral plate." The abdomen is separated from the head by a curved groove, as seen in Fig. 12 of my memoir.

The period examined is an interesting one, as while the cephalic appendages were well developed the abdominal appendages were not as yet indicated, nor the post-oral nervous ganglia.

The first point, which at once excited my attention, was the nature of the embryonic membrane, which I had previously regarded as the homologue of the amnion, and afterwards as the serous membrane of insects, but which Mr. J. S. Kingsley[3] has found to be secreted from the blastoderm. A thin section (Plate XXIV, Figs. 1 and 5) shows that the membrane is very thick, structureless, the cellular appearance being confined to the external surface. This membrane is evidently secreted by the blastoderm; the irregular cell-like markings (see my second memoir, 1880, Pl. III, Figs. 14, 14*a*, 14*c*, 14*d*) are, so to speak, casts of the blastoderm cells, which with the marks of even their nuclei are impressed upon the membrane during the early stage in its forma-

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] Read before the American Philosophical Society, January 16, 1885.

[3] The Development of Limulus, *Science Record*, II, pp. 249–251, Sept., 1884.